Similarities and Differences between Earthlike Magnetospheres

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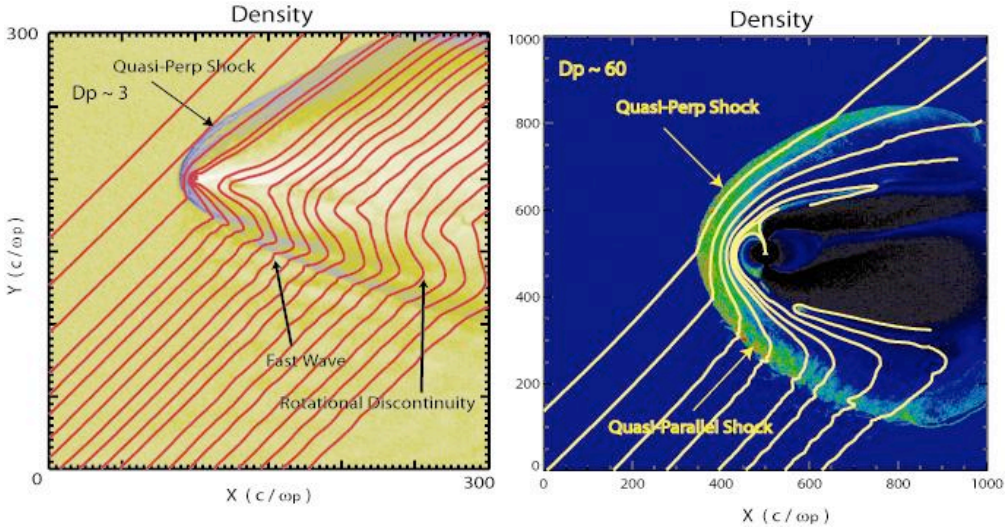
The solar wind interaction with planetary dipole magnetic fields of various strength produce a spectrum of magnetospheric structures with extents and complexities that increase with magnetization. This is quantified by the parameter D_p, the radial distance from the dipole to the point at which the solar wind ram pressure and magnetic pressure are balanced. New global hybrid model simulations show that although the structure of dipolar magnetospheres becomes Earthlike for D_p at ~ 20 (e.g., planet Mercury conditions), not all processes kick in at the same scale. For example, the quasi-perpendicular portion of the planetary bow shock is formed at D_p ~ 3 which is before the magnetosphere structure becomes terrestrial-like, but the quasi-parallel part of the shock does not become evident until values greater than 30. Hence, while global characteristics of magnetospheres become earthlike for D>20 not guaranteed that all the magnetospheres have the same characteristics.

Two simulations for different scale Earthlike magnetospheres



Parallel shock structure develops on the right, but not for the lower D_p value on the left. Quasi-perpendicular structures are similar*. Plasma densities are color shadings on top of magnetic field line topologies- gray depicting maximum density on the left and green-yellow on the right.*

Omidi, N., X. Blanco-Cano, H. Karimabadi, C. Russell, "Macrostructure of the bow shock and ion foreshock: Scale lengths, J. Geophys. Res., in preparation, 2005.